Decision and Solutions Guide

November 2002

IBM NetBAY Modular Power Distribution Options

NEW! ***Featuring the NEW 60amp NetBAY Single-Phase Front-end PDU***

Contents

Enhancing system and data availability with modular, space-efficient power distribution solutions from IBM

With the changes brought on by the new generation of Intel®-based servers, power distribution and power delivery are becoming critical issues. Only a few years ago, the quest was on to find ways to easily place 42 outlets in a rack for what was then an amazingly dense configuration of 1U servers. Today, there are more factors to consider than counting the power line cords and matching them to the number of outlets. The quest for outlet count has now been joined by the quest for delivering current adequate to feed the substantial power draw of today's servers. This trend toward higher current (amperage) draw in servers is making it more difficult to design a fault-tolerant PDU system.

IBM offers a family of modular "zero-U" power distribution units (PDUs) capable of supporting solutions from a handful of server to an array of large enterprise servers—all without consuming valuable rack space. These units can be configured to provide redundant power distribution, thus eliminating a point of failure and assuring higher levels of data availability.

The IBM offerings are developed specifically for use with sensitive electronic equipment, unlike many third party products which were designed for the desktop or industrial environments. There are compelling reasons why one should include IBM NetBAY PDUs in a rack-based IBM @server xSeries™ solution:

- Even in simple configurations, the combined power line requirement of devices in the rack can easily exceed the capacity of existing wall outlets. A PDU can help customers efficiently use the available power and the available outlets.
- A properly configured PDU solution can help customers increase availability and protect their system investments for a very affordable price. NetBAY PDUs can be used to provide an advanced fault-tolerant power distribution system.
- IBM's modular approach provides the flexibility to mix and match components as needed to configure a wide range of power distribution solutions. Universal voltage support plus single- and three-phase models provide solutions that can be used in virtually any facility or location, to meet almost any rack power requirement.
- These PDUs assume a three-year on-site limited warranty** when they are installed in an IBM NetBAY rack. Which means they include award-winning IBM service and support.
- A fully configured, all-IBM rack solution—including PDUs, uninterruptible power supply (UPS), console switches and cables—helps customers speed implementation with one-stop shopping and simplify installation with the assurance that all the pieces will work together out of the box.

About this Guide

Choosing a properly designed and properly protected PDU is more important than ever. This guide will provide an introduction to the IBM NetBAY family of PDUs and explain:

- The design philosophy driving the development of these products
- How to use, size and install PDUs
- Trends in power requirements for Intel-based servers and data center power architecture
- Factors to be considered when designing the layout of your power system.

**See page 17 for additional information on limited warranty.[2]

Products and solutions

Key features

The IBM NetBAY family of rack PDUs can help satisfy customer business needs for reliable, redundant power at a very competitive price point. Key features of these PDUs include:

Zero-space design

NetBAY PDU products are designed to mount in the sidewall compartment, preserving valuable "U" rack real estate for servers, storage devices and other rack options. Customers can mount several PDUs in a NetBAY rack's sidewall compartments.

High availability solutions

NetBAY PDU units can be configured to provide redundant power distribution for servers and other critical components. Plus, the Server Dual-cord PDU provides advanced fault tolerance for by connecting to two (primary and backup) power sources to each power supply.

Outstanding scalability and flexibility

Modular design allows you to mix and match components, adjusting configurations to accommodate growing power distribution needs, from total wattage to a sufficient number of outlets for rack-mounted equipment. Plus, by combining multiple units you can support rack-dense, power-hungry configurations such as:

- Up to 42 1U servers in a single rack
- A large array of multiple rack-optimized servers
- Clustered eight-way enterprise servers
- Large-scale redundant storage systems

Cord consolidation and cable management

Using short, easy to manage jumper cables to connect multiple rack devices to a single PDU, you can significantly reduce the number of individual power cords going from the rack to the wall. Plus, you can mount PDUs in sidewall pockets close to the equipment they support, helping reduce cable clutter.

Protection

Internal fuses in rack and front-end PDUs help protect equipment from catastrophic faults in connected devices.

Ease of use

NetBAY PDU products are quick and easy to install with included bracket hardware. Plus, the units are readily accessible, making it easy to plug and unplug components as needed.

IBM NetBAY PDU product family

Design philosophy

The design philosophy of the NetBAY line is twofold. First, make it easy to install and access outlets within the rack. Second, minimize the number of line cords that need to leave the rack in order to decrease the infrastructure that is needed to feed the rack without sacrificing scalable growth. IBM @server xSeries offerings pioneered the scalable modular approach to power distribution; our intelligent design has been making it easy for customers to support rack-dense environments for years.

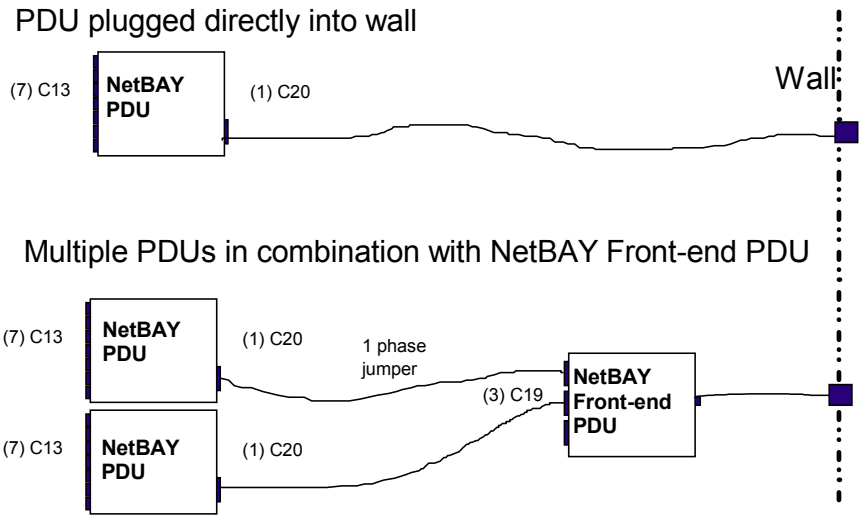
No matter the version that you choose, all of the IBM PDU products can help you meet demanding power requirements in the rack environment while saving space, consolidating line cords and providing easy access to outlets for scaling up and for cable management.

NetBAY Rack PDU

This PDU provides an economical, basic power distribution capability for rack-based systems, enabling you to satisfy the power requirements of each device without overtaxing your power source. It has one universal-voltage power input and supports up to seven devices with a combined power requirement of 1500W at 100Vac to 3600W at 240Vac (based on AC input volts).

- Universal voltage (100-240Vac, 50-60Hz)
- Brackets for vertical (sidewall) and horizontal (EIA space) rack mounting
- Two-pole 15-amp circuit breaker with time-delay protection
- Seven IEC 320-C13 power outlets (for connection to devices)
- One IEC 320-C20 power inlet (for connection to wall)
- Cable retention aids

This unit is designed to be used one of two ways: plugged into an appropriate wall outlet or, more commonly, used in conjunction with the innovative NetBAY Front-end PDUs. Below is a graphical overview of the two ways to use the NetBAY Rack PDUs:



NetBAY Front-end PDUs

NetBAY Single-phase Front-end PDUs
NOW AVAILABLE in 30amp and 60amp versions

NetBAY Single-phase Front-end PDUs provide a front-end wiring box to allow connection of multiple Rack or Server Dual-cord PDU models to higher current single-phase circuits. These modular, front-end PDUs provide three single-phase output circuits from one single-phase (100V-240V at 30amp or 200V-240V at 60amp) input circuit.

- Adapts to high-current circuits (three-wire, single-phase)
  - 100V-240V at 30amp, supports up to 3000W at 100V or up to 7200W at 240V
  - 200V-240V at 60amp, supports up to 9000W at 200V or up to 10,800W at 240V
- Three single-phase output circuits, with three IEC 320-C19 inputs (for connection to PDUs)
- Non-replaceable fuse for protection
- Brackets for vertical (sidewall) rack mounting only
- Cable retention aids

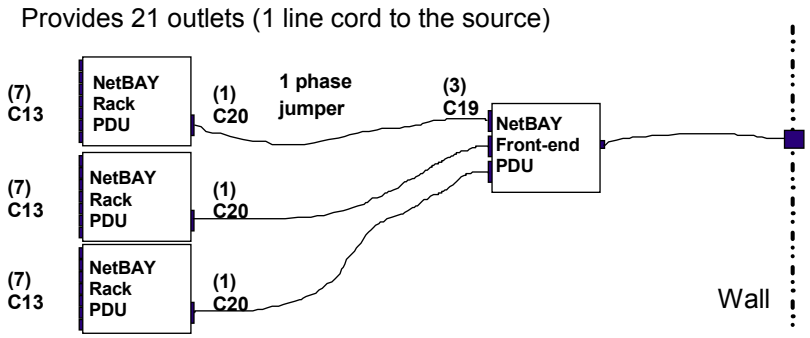
The brand-new NetBAY 60amp Front-end PDU is the perfect choice for servers like x345, x335, x440 and IBM @server BladeCenter™. This high amperage product offering will make it easier for customers to support large installations of these servers, reducing the number of line cords and helping reduce electrical power infrastructure needed to feed the rack.

NetBAY Three-phase Front-end PDU

The NetBAY Three-phase Front-end PDU provides a front-end wiring box to allow connection of multiple Rack or Server Dual-cord PDU models to five-wire, three-phase circuits. This modular, front-end PDU provides three single-phase output circuits from one five-wire, three-phase (208V/120V or 400V/230V) input circuit

- Adapts to high-current circuits (five-wire, three-phase)
- Three single-phase output circuits, with three IEC 320-C19 inputs (for connection to PDUs)
- Non-replaceable fuse for protection
- Brackets for vertical (sidewall) rack mounting only
- Cable retention aids

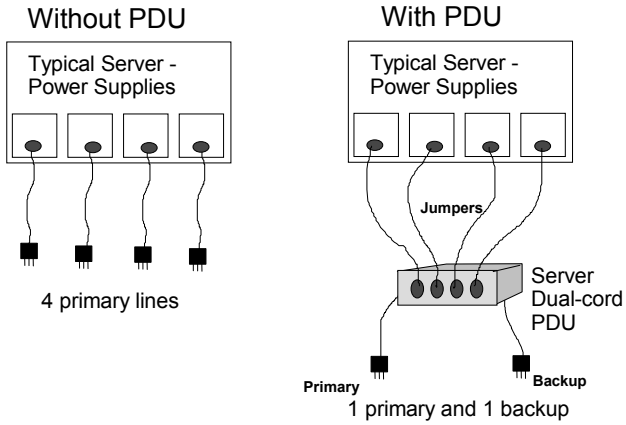
NetBAY Front-end PDU configuration



NetBAY Server Dual-cord PDU

The NetBAY Server Dual-cord PDU provides greater fault tolerance. The unit functions as an automatic bus transfer switch that provides universal voltage (100V to 240V) distribution for one server from one of two independent power sources. One of the source circuits is considered the primary source. If the primary source fails, the unit will automatically switch the loads to the backup source circuit. This PDU can be used plugged into a wall outlet or used in conjunction with the NetBAY Front End PDUs.

- Universal voltage (100V-240V AC 50/60Hz) AC power distribution for one or more servers from either of two power sources
- Power failure sensing - automatically switches from primary power source to backup power source circuit; transfer time is 35mSec or less
- Power can be sourced from either Uninterruptible Power Supply or wall source
- Four IEC 320-C13 power outlets
- Two IEC 320-C20 power inlets
- Brackets for vertical (sidewall) and horizontal (EIA space) rack mounting
- Cable retention aids



NetBAY NEMA-style PDU

This PDU provides an economical, basic power distribution capability for rack-based systems, enabling you to satisfy the power requirements of each device without overtaxing your power source. It has one low-voltage power input and supports up to eight devices with a combined power requirement of up to 1500W at 100V through 1905W at 127V. This PDU is primarily used in North America, Japan, Taiwan, the Philippines and various other nations that have power systems that work at 100V-127V.

- Low voltage (100V-127V)
- Brackets for vertical (sidewall) and horizontal (EIA space) rack mounting
- Two-pole 15-amp circuit breaker with time-delay protection
- Eight NEMA 5L-15 power outlets
- Fixed L5-15 line cord
- Cable retention aids

Unlike the rest of the IBM PDU product line, this unit is designed to be used on its own, not in combination with Front-end PDU units. Simply plug it into the wall and power up as many as eight devices. While this is a 1U PDU, it has a different form factor from the modular NetBAY PDU family members. It does not allow the flexibility of mounting that the modular PDU products offer.

IEC versus NEMA standard

Why IEC is the best outlet choice for your rack systems

For many customers, there is no choice: IEC C13-based PDUs are the accepted standard for internal rack power outlets for the vast majority of the countries around the world. But for customers in North America, Japan, Saudi Arabia and select other nations, the NEMA standard is an available alternative.

The NEMA outlet on our NetBAY NEMA PDU is the same size and shape as many wall outlets where 100-127V power systems are used. The larger size of the NEMA outlet means that fewer outlets can be incorporated into the same "real estate" on a piece of electronic equipment. As a result, products with NEMA outlets typically are less dense and not as flexible as products designed with IEC outlets.

The IEC C13 outlet design has been adopted throughout the world as the choice for internal rack power. Unlike country-specific outlets, the IEC C13 outlet extends beyond all country borders and across all types of power distribution types, from 100V all the way to 240V. The majority of the benefits engineered into the IBM line of modular PDU products originate from the higher density, smaller-sized IEC outlets. These benefits make IEC-based PDU products the best choice for internal-rack power distribution, including:

- Universal support for both low voltage (100V-127V) and high voltage (200V-240V) input in a single product, providing enhanced flexibility and investment protection
- Optimizing device support in a small space, helping to conserve valuable rack real estate
- The platform that IBM will support for innovation going forward because it enables us to focus resources in a production line that can be used worldwide

	Rack PDU (IEC)	NEMA PDU
Can be used with NetBAY Front-end PDUs to reduce cord clutter?	**YES**	**NO**
Maximum number of outlets in full 1U rack width	**14**	**8**
Able to adapt to high voltage inputs?	**YES**	**NO**
Mountable on same hardware as the rest of the Modular PDU family?	**YES**	**NO**

The benefits of NetBAY modular PDUs

Customer requirements

Keeping today's enterprise up and running is a top priority for IT managers. Server downtime originates from many sources, but often, it is due to unexpected power problems stemming from natural disasters, faulty electrical systems, poor quality power or an accidental cutting of electrical lines. At the same time, the power requirements of ever-more powerful computing equipment continue to grow. With rack-dense solutions allowing companies to fit an old data center's worth of computing horsepower into the space of a small wiring closet, IT managers can find it difficult to keep the electricity flowing.

To meet new high-availability requirements, a fault-tolerant system design must address power management. Solution components include:

- PDUs to assure that the combined line-cord requirement of all rack-mounted equipment is met
- Redundant configurations that provide power from separate wall sources to enable failover capability
- In unprotected data center environments, combining PDUs with uninterruptible power supply (UPS) products for even greater levels of reliability in the event of a power failure.

In addition, power fault tolerance solutions should address requirements for:

- Preserving valuable "U" space in a rack that quickly fills up with network critical equipment
- Easy serviceability, high reliability, and high availability
- Scalable and flexible systems that grow with changing network demands.

The use of NetBAY PDUs alone may not solve all the issues with power that we are facing today. Many problems such as power surges, brownouts, under-voltage and the like can only be protected against by the use of the right UPS products. IBM offers a complete suite of power-protecting UPS products. For detailed information on these products and how to choose the right one for your application, download the *IBM Decision Maker's Guide to Selecting the Right UPS* from: http://www.pc.ibm.com/ww/eserver/xseries/rack.html

Key messages

- Innovative, modular design to reduce line cords leaving the rack, while increasing outlet count possible in a rack.
- Buying a PDU with attached line cord rather than one that is hard wired saves money. No need for an electrician visit to power the NetBAY PDUs up, just plug them into an appropriate wall outlet.
- IBM NetBAY PDUs can be configured to provide redundant power distribution, thus eliminating a single point of failure and helping increase data availability.
- Designed for IBM servers. Unlike the PDUs one might find at local retailers or available from third parties, IBM PDUs provide protection against overload and surge.
- There is no better way to speed solution set up than with IBM PDUs in combination with IBM racks. We design our PDUs with NetBAY racks in mind. When you combine IBM rack and IBM power, you get simple, quick, stable, and thoughtful solutions.
- The modularity of the IBM PDUs make it easy to support a handful of servers to an entire rack.

Selection questions

Selection questions	Rationale for asking
Do you currently have the infrastructure in place to run multiple line cords to the rack?	If not, the modular design of the NetBAY PDUs may prevent you from having to run new lines, a huge cost savings for customers adding a new rack or adding to their existing solution.
Do you anticipate adding new servers to your environment?	IBM NetBAY PDU solutions scale easily to accommodate growing rack configurations. Customers can start with a single Rack PDU, and add more Rack PDUs or Front-end PDUs as needs grow.
Is your business-critical data adequately protected in the event of a power outage? How much downtime can your business tolerate until systems can be brought back online?	IBM NetBAY PDUs can be configured to provide redundant power distribution. Plus, these units can be used in combination with select rack-mountable UPS products from IBM to provide an advanced fault-tolerant power distribution system.

Product specifications

Model	Rack PDU	Server Dual-cord PDU	Single-Phase Front-end PDU 30amp	NEW! Single-Phase Front-end PDU 60amp	Three-Phase Front-end PDU
Part number	37L6866	37L6865	37L6883/84	3P5790/73P5789	37L6886
Form factor	•Rack/1U, half width	•Rack/1U, half width	•Rack/1U, half width	•Rack/1U, half width	•Rack/1U, half width
Description	•Universal voltage general purpose PDU	•Universal voltage redundant power switch for servers with multiple power supplies	•Wiring unit for adapting a three-wire, single-phase circuit to three single phase branch circuits	•Wiring unit for adapting a three-wire, single-phase circuit to three single phase branch circuits	•Wiring unit for adapting a five-wire, three-phase circuit to three single phase branch circuits
Capacity Low Voltage High Voltage	 •Up to 1700W •Up to 3100W	 •Up to 2400W •Up to 2400W	 •Up to 2300W •Up to 4800W	 •— •10,8000W	 •— •Up to 5400W
Device support	•Seven IEC outlets •Supports up to seven devices	•Four IEC outlets •Supports one server from either of two power sources	•Three IEC outlets •Supports up to three Rack or Server Dual-cord PDUs	•Three IEC outlets •Supports up to three Rack or Server Dual-cord PDUs	•Three IEC outlets •Supports up to three Rack or Server Dual-cord PDUs
Cord capabilities *Plug type* Low Voltage	•One line cord	•Two line cords	•One line cord	•One line cord	•One line cord
	•NEMA L5-20P	•NEMA L5-20P (two each)	•NEMA L5-30P	•—	•—
High Voltage	•NEMA L6-20P	•NEMA L6-20P (two each)	•NEMA L6-30P	•IEC 309-60P N.A. •IEC 309-63P Intl.	•NEMA L21-30P
Power Source	•100-240Vac, 50/60Hz (single phase)	•100-240Vac, 50/60Hz (single phase)	•100-240Vac, 50/60Hz (single phase)	•200-250Vac, 50/60Hz (single phase)	•200-250Vac, 50/60Hz (three phase)
Mounting option	•Sidewall or EIA space	•Sidewall or EIA space	•Sidewall	•Sidewall	•Sidewall
Protection	•15a circuit breaker NA (Built into xSeries or Netfinity system)	•Non-replaceable fuse included with each output circuit for protection	•Non-replaceable fuse included with each output circuit for protection	•Non-replaceable fuse included with each output circuit for protection	
Dimensions	•43mm x 192mm x 221mm (1.7" x 7.5" x 8.7")	•43mm x 192mm x 221mm (1.7" x 7.5" x 8.7")	•43mm x 192mm x 221mm (1.7" x 7.5" x 8.7")	•43mm x 192mm x 221mm (1.7" x 7.5" x 8.7")	•43mm x 192mm x 221mm (1.7" x 7.5" x 8.7")
Warranty**	• 3-year limited onsite warranty when installed in an IBM NetBAY rack				

**See page 17 for additional information on limited warranty.[2]

Sizing and configuring PDU solutions

Step 1:
Identify the devices contained in the rack configuration

Step 2:
Sum the total load (watts) and total outlet requirements of all devices in the configuration.

Servers	# Power Cords	Std/Max Watts Load Max/Typica
xSeries 200	1/1	350/245
xSeries 205	1/1	485/340
xSeries 220	1/1	350/245
xSeries 232 (one 385W power supply)	1/1	400/280
xSeries 232 (two 250W power supplies)	2/3	450/315
xSeries 235	1/2	800/560
xSeries 240	2/3	450/315
xSeries 250	2/4	475/350
xSeries 255	2/4	1000/530
xSeries 300	1/1	200/140
xSeries 305	1/1	200/140
xSeries 330	1/1	200/140
xSeries 335	1/1	340/245
xSeries 342	1/2	390/270
xSeries 345	1/2	500/350
xSeries 350	1/3	525/365
xSeries 360	2/3	740/520
xSeries 370	3/3	1450/1015
xSeries 380	2/2	2000/1400
xSeries 440	2/2	950/950
Other Devices		
RXE-100 (8684-1RX)	2/2	370/260
EXP300 Storage Expansion Unit (3531)	2/2	360/285
FAStT200 Storage Server (35421RU)	2/2	390/275
FAStT200 HA Storage Server (35422RU)	2/2	390/275
FAStT500 Storage Server (35521RU)	2/2	200/140
FAStT700 Storage Server (17421RU)	2/2	390/275
FAStT EXP500 Storage Expansion Unit (35601RU)	2/2	350/245
FAStT EXP700 Storage Expansion Unit (17401RU)	2/2	350/245
SAN Fibre Channel Switch, 8-port (2109S08)	1/2	200/n/a
SAN Fibre Channel Switch, 16-port (2109S16, 2109F16)	1/2	200/n/a
TotalStorage SAN Switch F08, 8-port (3534F08)	1/1	50/n/a
SAN Data Gateway Router UltraSCSI LVD Port (2108R3L)	1/1	90/n/a
DLT Tape Autoloader and Library (3502)	1/1	135/n/a
Magstar® MP 3570 Tape Subsystem (C2x)	1/1	200/140
NetMEDIA Storage Expansion Unit EL (3551)	2/2	185/130
3600 Series Tape Autoloader and Library (3600xxx)	1/1	700/500

Installation and use of NetBAY PDUs

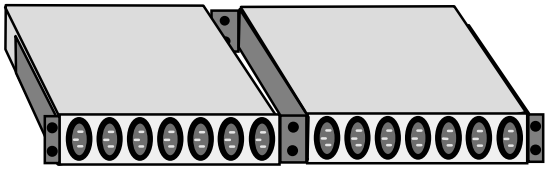
Installation options in NetBAY rack models

NetBAY PDUs, part of the NetBAY family of rack-based products, are designed to easily install and work within all IBM NetBAY rack offerings. To gain a better understanding of the NetBAY rack family of products and all the benefits they offer, please see the *Decision Maker's Guide to IBM Rack Solutions*, available on the IBM @server xSeries rack and rack solutions Web page at www.pc.**ibm.com**/ww/eserver/xseries/rack

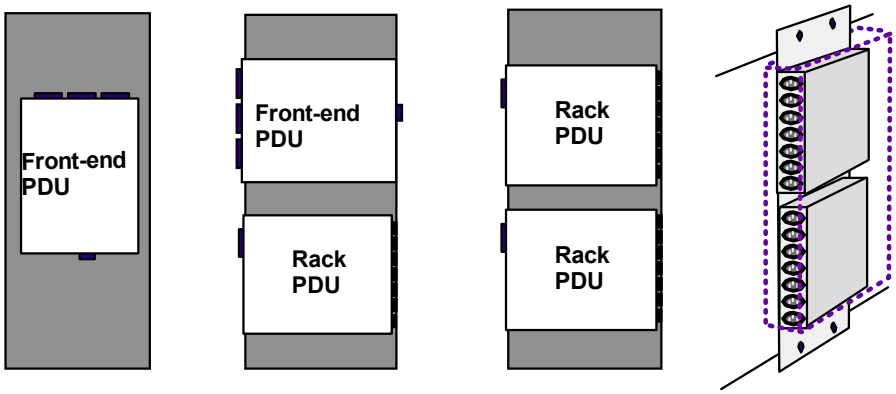
NetBAY PDUs also were designed to be mounted in any EIA-standard rack offering, but given the diversity of rack designs, many of the benefits for flexible mounting do not apply to non-IBM racks.

Basic installation ideas

The NetBAY modular PDUs can be mounted in a variety of methods. The simplest is to mount these in the EIA space of the rack as shown here. Two Rack PDUs can be installed like this to make accessing the PDUs extremely easy. Many customers choose to mount PDUs this way for the serviceability benefits.

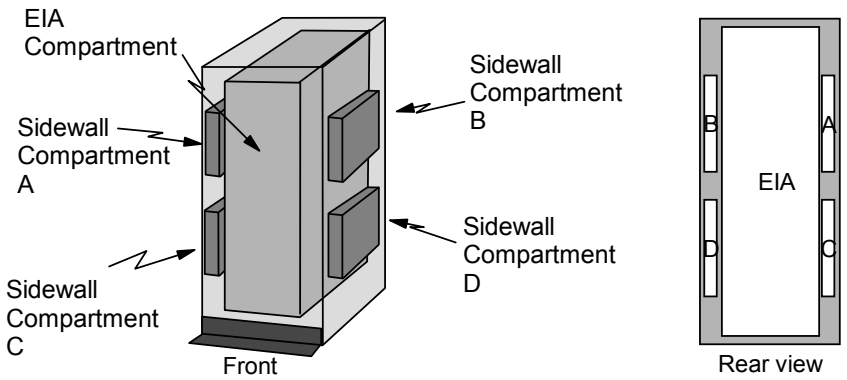


A more space-efficient method for mounting the NetBAY PDUs is to install them in the side pockets of the rack. The following examples can all be accomplished using the standard hardware provided with the PDUs. Each of these "nested" configurations can be placed in a variety of ways in the different NetBAY racks.

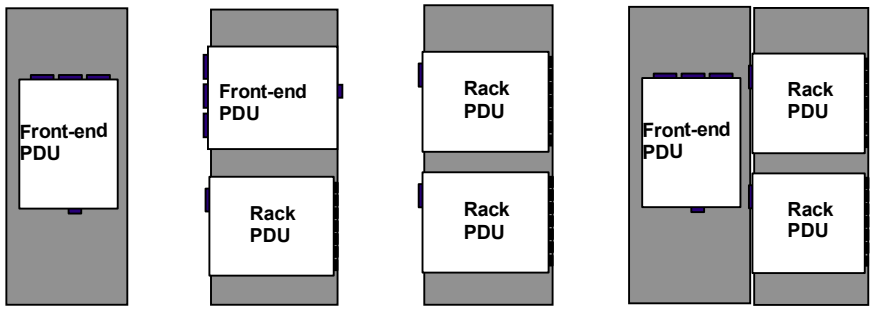


NetBAY Enterprise Rack installation options

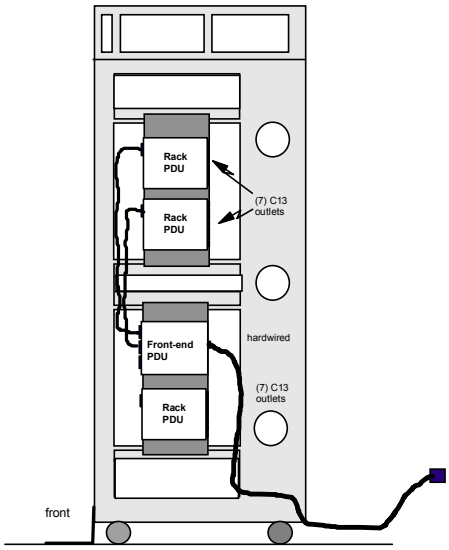
The NetBAY Enterprise Rack is the premier IBM rack, offering four deep side pockets that enable the greatest variety of side pocket mounting options. This flexibility is one of the major benefits of choosing this rack. Using all the available space in the side pockets of this rack enables customers to install up to 84 outlets in this rack without sacrificing any valuable “U” space. The picture below details these side pockets and provides a lettering guide to make explaining installation location easier.



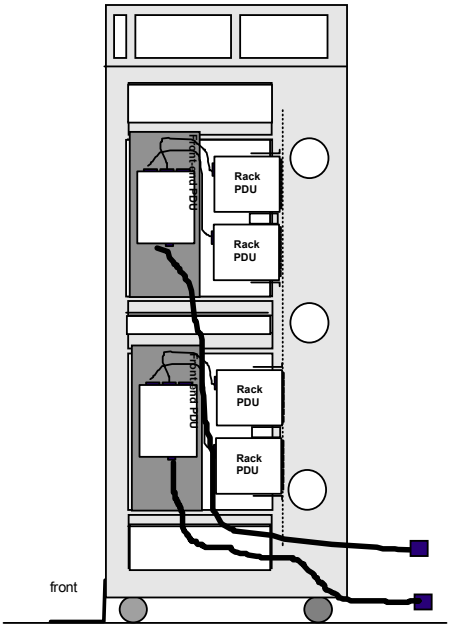
The depth of these side pockets allows the PDUs to be nested side by side for support of very large numbers of PDUs or KVM switches in the rack’s pockets. Here are a few examples of the supported installations for the Enterprise Rack.



The illustration below further clarifies how the rack looks once these PDUs are installed. This example shows only a single “nest” but this could easily contain more than one per pocket.

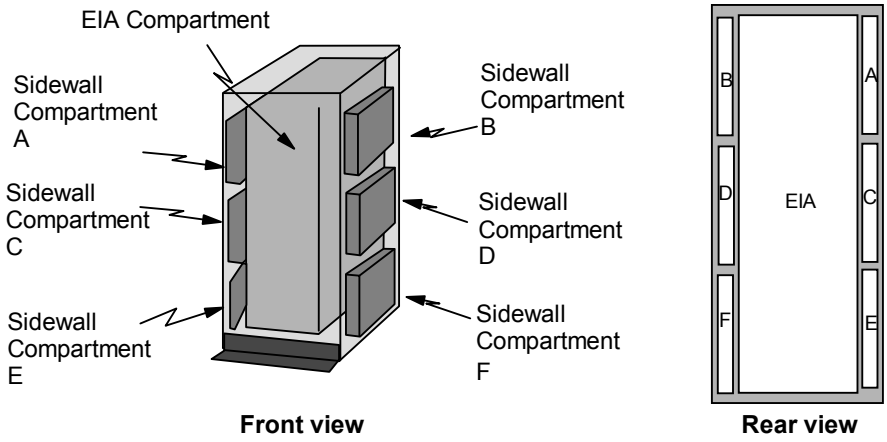


One other very nice feature of the Enterprise Rack is the fact that it has 4 1U pockets that are accessible and visible from the rear of the rack. It is possible with the Enterprise Rack to install a pair of PDUs in these 1U pockets using the horizontal mounting hardware.

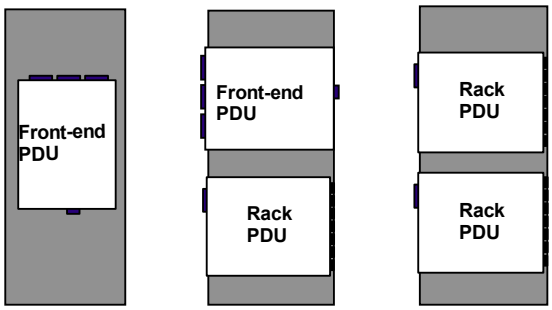


IBM Standard Rack installation options

This entry rack offers six side panel pockets mounting locations. While it has more side pockets than the Enterprise Rack, the Standard Rack's pockets are much less deep and do not allow the variety of mounting options of the Enterprise Rack. Even so, customers can install up to 56 outlets in the Standard Rack without sacrificing any "U" space. Here is graphical depiction of the side pockets of the Standard Rack along with a lettering guide.



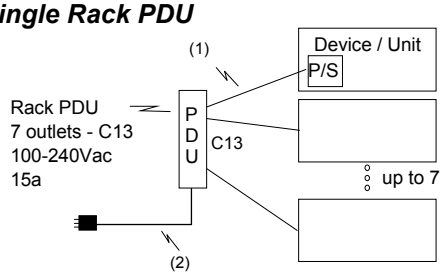
The only accepted mounting is for single sets of PDUs in each pocket as shown below.



Sample configurations to maximize uptime and availability

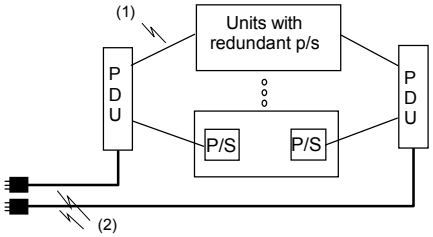
The pictures below detail ways to use PDUs to maximize uptime and availability of your solution. The first illustration shows the simplest configuration, with a Rack PDU plugged into a wall outlet or a Front-end PDU outlet. This simple topology provides non-protected, non-redundant power for up to seven devices.

Single Rack PDU



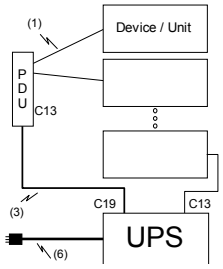
Addition of a second PDU to this yields redundancy back to the power source. With this topology, even if one power source is lost, the second power source and PDU will power the load without bringing the solution down.

Redundant Power Distribution

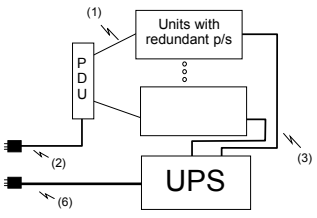


The last three topologies go a long way in preventing the majority of power problems that effect equipment today. All these topologies involve the use of a UPS product to add power conditioning and battery backup in case of an outage. Notice how much better the load on these PDUs is protected when used in combination with the proper UPS.

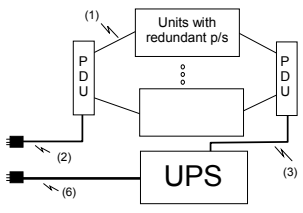
PDU used as UPS back-end



Redundant Power Distribution with PDU and UPS



Redundant Power Distribution with PDU and UPS with PDU



xSeries Rack Configurator software

While this Guide provides a basic understanding of the way in which NetBAY PDUs are used and installed, the complexity of today's power solutions and the variety of sizes, access options and cabling requirements of servers, accessories and storage components make configuring a complex networked system a challenge. A more detailed sizing tool is needed. The IBM @server xSeries Rack Configurator provides this functionality. It is an easy-to-use tool that helps you design the optimum layout. The configurator helps check, correct and report the following:

- Components by product number and position
- Infrastructure specifications, including weight, power, volt-amps (VA), heat (BTU/hr), bays, EIA, outlets and console ports
- Width and depth; front, rear and side clearances; total weight and top clearance
- Cables and connectors by component position

You can download the configurator software from **ibm.com**/pc/us/eserver/xseries/library/configtools. The configurator is the best source of accurate information on designing a redundant, reliable power distribution topology. Individual User and Installation Guides also provide detailed information on the use and mounting of for NetBAY PDU products. These are available from the IBM Web site.

Country-specific considerations

To accommodate the wide variety of country-specific power systems, line cords and wiring rules, IBM offers a large number of PDU options. This section will provide basic detail of what each of these country-specific PDU options are and how they would be used. For more details, contact your local IBM representative.

Americas

Power Cables:

(1) Device to Rack PDU power cable
IEC C13 to C14, 10/15a cable
typical: pn 36L8886 (2.8m)
requirement: C14 plug, long enough to reach
available option: 94G7448 (14ft)

(2) Rack PDU to Wall line cord →
IEC C19 to country-specific connector, 16/20a, 14ft (4.3m)

(3) Rack PDU to UPS power cable
IEC C19 to C20, 16/20a
00N7700 (2m)
provided with 37L6861 (APC SU-5000RMB)

(4) Rack PDU to Front-end PDU power cable
IEC C19 to C20, 16/20a
00N7698 (1m)
provided with the Front-end PDUs

(5) FE PDU to Wall line cord →
special to country-specific connector, 30a, 8.2ft (2.5m)

(2) Line Cords: Rack PDU

Part Number	**Plug Type**	**Source Circuit (single phase 50/60Hz)**	**PDU Output (single phase 50/60Hz)**
37L6866	NEMA L5-20P	100-127Vac, 20a	Seven 100-127Vac, shared 15a
	NEMA L6-20P	200-240Vac, 20a	Seven 200-240Vac, shared 15a

(5) Line Cords: Type W PDU

Part Number	Plug Type	Source Circuit (50/60Hz)	PDU Output (single phase 50/60Hz)
37L6883	NEMA L5-30P	100-127Vac, 30a, single-phase	Three 100-127Vac, 20a each, shared 30a
37L6884	NEMA L6-30P	200-240Vac, 30a, single-phase line-to-line with ground	Three 200-240Vac, shared 20a
37L6886	NEMA L21-30P	200-250Vac, 30a, three-phase Y-connection with neutral	Three 100-127Vac (115-145), 20a each
73P5790	IEC 309-2P+G	200-208Vac, 60a, single-phase	Three 200-208Vac, 16a each
73P5789	IEC 309-2P+GP	200-240Vac, 63a, single-phase	Three 220-240Vac, 16a each

AP/EMEA

Power Cables:

(1) Device to Rack PDU power cable
IEC C13 to C14, 10/15a cable
typical: pn 36L8886 (2.8m)
requirement: C14 plug, long enough to reach
available option: 94G7448 (14ft)

(2) Rack PDU to Wall line cord
IEC C19 to country-specific connector, 16/20a, 14ft (4.3m)

(3) Rack PDU to UPS power cable
IEC C19 to C20, 16/20a
00N7700 (2m)
provided with 37L6861 APC SU-5000RMB

(4) Rack PDU to Front-end PDU power cable
IEC C19 to C20, 16/20a
00N7698 (1m)
provided with the Type W PDUs

(5) Front-end PDU to Wall line cord
special to country-specific connector, 30/32a, 8.2ft (2.5m)

(2) Line Cords: Rack PDUs

Part Number	Plug Type	Source Circuit (single phase 50/60Hz)	PDU Output (single phase 50/60Hz)
37L6866	NEMA L5-20P	100-127Vac, 20a	Seven 100-127Vac, shared 15a
	NEMA L6-20P	200-240Vac, 20a	
37L6868	CEE7-VII	220-240Vac, 16a	
37L687₀	IEC 309-2P+Gnd	220-240Vac, 16a	
37L6872	SII 32	220-240Vac, 16a	Seven 200-240Vac, shared 15a
37L6874	CEI 23-16	220-240Vac, 16a	
37L6876	SABS 164	220-240Vac, 16a	
06P6028	BS 1363/A	220-240Vac, 13a	
37L6864	country-specific line cord provide by IBM	country specific	country specific

(5) Line Cords: Front-end PDUs

Part Number	Plug Type	Source Circuit (50/60Hz)	PDU Output (single phase 50/60Hz)
37L6883	NEMA L5-30P	100-127Vac, 30a, single-phase	Three 100-127Vac, 20a each, shared 30a
37L6884	NEMA L6-30P	200-240Vac, 30a, single-phase line-to-line with ground	Three 200-240Vac, shared 20a
37L6886	NEMA L21-30P	200-250Vac, 30a, three-phase Y-connection with neutral	Three 100-127Vac (115-145), 20a each
37L6885	IEC 309-2P+Gnd	220-240Vac, 32a, single-phase	Three 220-240Vac, 16a each, shared 32a
37L6887	IEC 309-3P+N+Gnd	380-415Vac, 32a, three-phase Y-connection with neutral	Three 220-240Vac, 16a each
73P5790	IEC 309-2P+G	200-208Vac, 60a, single-phase	Three 200-208Vac, 16a each
73P5789	IEC 309-2P+G	200-240Vac, 63a, single-phase	Three 220-240Vac, 16a each

Japan

Power Cables:

(1) Device to Rack PDU power cable
IEC C13 to C14, 10/15a cable
typical: pn 36L8886 (2.8m)
requirement: C14 plug, long enough to reach
available option: 94G7448 (14ft)

(2) Rack PDU to Wall line cord
IEC C19 to country-specific connector, 16/20a, 14ft (4.3m)

(3) Rack PDU to UPS power cable
IEC C19 to C20, 16/20a
00N7700 (2m)
provided with 37L6861 APC SU-5000RMB

(4) Rack PDU to Front-end PDU power cable
IEC C19 to C20, 16/20a
00N7698 (1m)
provided with the Front-end PDUs

(5) Front-end PDU to Wall line cord
special to country-specific connector, 30/32a, 8.2ft (2.5m)

(2) Line Cords: Rack PDUs

Part Number	Plug Type	Source Circuit (single phase 50/60Hz)	PDU Output (single phase 50/60Hz)
37L6866	NEMA L5-20P	100Vac, 20a	Seven 100Vac, shared 15a
	NEMA L6-20P	200Vac, 20a	Seven 200Vac, shared 15a

(5) Line Cords: Front-end PDUs

Part Number	Plug Type	Source Circuit (50/60Hz)	PDU Output (single phase 50/60Hz)
37L6883	NEMA L5-30P	100-127Vac, 30a, single-phase	Three 100-127Vac, 20a each, shared 30a
37L6884	NEMA L6-30P	200-240Vac, 30a, single-phase line-to-line with ground	Three 200-240Vac, shared 20a
37L6886	NEMA L21-30P	200-250Vac, 30a, three-phase Y-connection with neutral	Three 100-127Vac (115-145), 20a each
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37L6887	IEC 309-3P+N+Gnd	380-415Vac, 32a, three-phase Y-connection with neutral	Three 220-240Vac, 16a each
73P5790	IEC 309-2P+G	200-208Vac, 60a, single-phase	Three 200-208Vac, 16a each
73P5789	IEC 309-2P+G	200-240Vac, 63a, single-phase	Three 220-240Vac, 16a each

Preparing for the future

Roadmaps for Intel processors confirm that the trend of increasing power requirements and thermal output for servers will continue in the short and long term. Therefore, it is critical that companies take this trend into consideration when making investments in data center infrastructure, including power service. Escalating power and thermal output requirements of Intel-based servers will soon approach levels traditionally seen in mainframes.

Here are a few points to consider moving forward:

- When designing new data centers, consider the addition of 60amp and 125amp service feeds in your plans. With continued growth in server power requirements, 60amp and even 125amp service feeds are likely to become standard for data centers in the coming years. If 60amp is not currently needed, consider installing wiring that can handle a future upgrade to 60amp service.
- While not commonplace today, delta power and three-phase service will become much more widely used. A look into these power distribution systems now might be helpful. The NetBAY Three-Phase Front-end PDU is a great way to maximize power delivery to servers.
- The power requirements and thermal output of individual racks are rising and may be bumping the limits of today's cooling and power delivery. One must carefully consider how new equipment will be cooled and powered. Products like the IBM @server BladeCenter will increase the processing power in a single rack, but given its enormous density this product may actually reduce overall data center power needs and thermal loading.
- Customers in countries that can choose to use either a NEMA-style PDU or an IEC C13-based PDU can gain an advantage by making the move now to the IEC standard. The IBM NetBAY IEC-based PDUs allow migration from low voltage to high, or single phase to three phase, simply by changing the front-end PDU used. This means you can have an easy way to scale up your power topology without completely replacing your investment in power distribution equipment.
- Customers who can choose between low voltage and high voltage should select high voltage whenever possible. Already, the amperage needed to run several of today's servers cannot be easily met with 100-127V power feeds.
- When choosing PDUs make sure you look to offerings that allow quick and easy scalability. The modular design of the IBM PDUs means that addition of outlets may be as simple as adding a single Rack PDU, eliminating the need for more wiring to the rack in most cases.
- Buying an all-IBM solution that includes IBM NetBAY Racks, rack options and PDUs can help ensure that your server investment is both easy to install and safe from power or thermal problems. As server installations grow in complexity, the decision of which rack products to buy becomes critical. Will a non-IBM rack handle the thermal loads you will require in the future? IBM Rack products are tested to make sure they work with IBM servers and the cooling methodologies that they employ. Non-IBM racks may not meet these requirements. Will a non-IBM PDU be capable of both protecting and powering the servers of tomorrow? A lot of thought goes into how our PDUs fit into our server roadmap. IBM is confident that the PDU you buy today will be an investment that continues to provide value even as server power requirements grow and change.

Additional resources

IBM @server xSeries Racks and rack options
ibm.com/pc/ww/eserver/xseries/rack

IBM @server xSeries Options
ibm.com/pc/us/eserver/xseries/storage

IBM @server xSeries Rack Configurator
ibm.com/pc/us/eserver/xseries/library/configtools

IBM @server xSeries Configuration and Options Guide
ibm.com/pc/us/eserver/xseries/library

Important notes and trademarks

1) A single U, or rack unit, is 1.75" or 44.5mm.

2) For terms and conditions or copies of the IBM limited warranty, call 1 800 772-2227 in the U.S. and in Canada call 1 800-426-2255. Limited warranty includes International Warranty Service in those countries where this product is offered. Registration is required. Telephone support may be subject to additional charges. For warranties including on site service, IBM sends a technician after attempting to resolve the problem remotely.

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